INVESTIGATION 4-A

Newton's Cradle

TARGET SKILLS

- **Hypothesizing**
- **Performing and recording**
- **Analyzing and interpreting**

Newton's cradle, also called a "Newtonian demonstrator," looks like a simple child's toy. However, explaining the motion of Newton's cradle requires the application of more than one important physical principle.

Problem

Explain the motion of a Newton's cradle.

Equipment

- Newton's cradle
- modelling clay

Procedure

1. Pull to the side one sphere at the end of the row of the Newton's cradle, keeping the supporting cords taut. Then, release the sphere. Observe and record the resulting motion of the spheres.
2. Pull two spheres to the side, keeping all of the supporting cords taut and keeping the spheres in contact. Release the spheres and observe and record the resulting motion.
3. Repeat step 2, using first three spheres and then four spheres.
4. Pull back two spheres from one end and one sphere from the other end. Release all of the spheres at the same time. Observe and record the motion.
5. Pull one of the end spheres aside and put a small piece of modelling clay on the second sphere at the point where the first sphere will hit it. Release the first sphere and observe and record the motion of the spheres.
6. Leaving the clay in place between the two spheres, pull back one sphere from the opposite end of the row. Release the sphere and observe and record the resulting motion.

Analyze and Conclude

1. Summarize any patterns of motion that you observed for the various trials with the Newton's cradle.
2. Imagine that an end sphere was moving at 0.16 m/s when it hit the row and that two spheres bounced off the other end. What would the speed of the two spheres have to be in order to conserve kinetic energy? Assume that each sphere has a mass of 0.050 kg.
3. Could kinetic energy be conserved in the pattern described in question 2? During your trials, did you ever observe the pattern described in question 2?
4. Did you ever observe a pattern in which more than one sphere was released and only one sphere bounced off the far end?
5. Propose a possible explanation for the motion you observed in Procedure steps 5 and 6.
6. Momentum is involved in the motion of the spheres. Write a definition of momentum as you now understand it.
7. Formulate an hypothesis that could explain why some patterns that would *not* violate the law of conservation of energy were, however, *not* observed.
8. As you study this chapter, look for explanations for the patterns of motion that you observed. Reread your hypothesis and make any necessary corrections.